DOCUMENT RESUME

ED 161 435 IR 006 400

AUTHOR	Lyman, Elisabeth R.
TITLE	PLATO Highlights, Fifth Revision.
INSTITUTION	Illinois Univ., Urbana. Computer-Based Education Lab.
PUB DATE	Mar 78
NOTE	58p.
AVAILABLE FROM	Computer-Based Education Research Laboratory, University of Illinois, Urbana, Illinois ($2.60)
EDRS PRICE	MF-$0.83 HC-$3.50 Plus Postage.
DESCRIPTORS	*Bibliographies; *Computer Assisted Instruction; Computers; Educational Innovation; *Financial Support; Geographic Distribution; Graphs; *Historical Reviews; Instructional Materials; Networks; Program Descriptions; Programing Languages
IDENTIFIERS	*PLATO

ABSTRACT

This description of the PLATO system over its first seven years describes the development of PLATO III and PLATO IV, lists financial supporters of the PLATO project from 1960 to 1977, outlines highlights in its history, and provides a chronological list of publications about the system. Figures include the locations and increasing numbers of PLATO terminals at the University of Illinois and student usage by year. (CMV)

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PLATO® HIGHLIGHTS

by

Elisabeth R. Lyman

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COMPUTER-BASED EDUCATION RESEARCH LABORATORY

UNIVERSITY OF ILLINOIS, URBANA, ILLINOIS

MARCH, 1978

Fifth Revision

12.60

IR006400

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First printing May 1974
Revised 1974,1975,1976,1977,1978

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Grateful acknowledgement is expressed to the many supporters of the PLATO project who are listed on page 11 of this report.

Acknowledgements

Sincere appreciation is expressed to William Golden for his encouragement and helpful suggestions during the writing of my publications.

Gratitude is also due to the help during the manuscript preparation of Deborah Postlewait, Roy Lipschutz, and Wayne Wilson.

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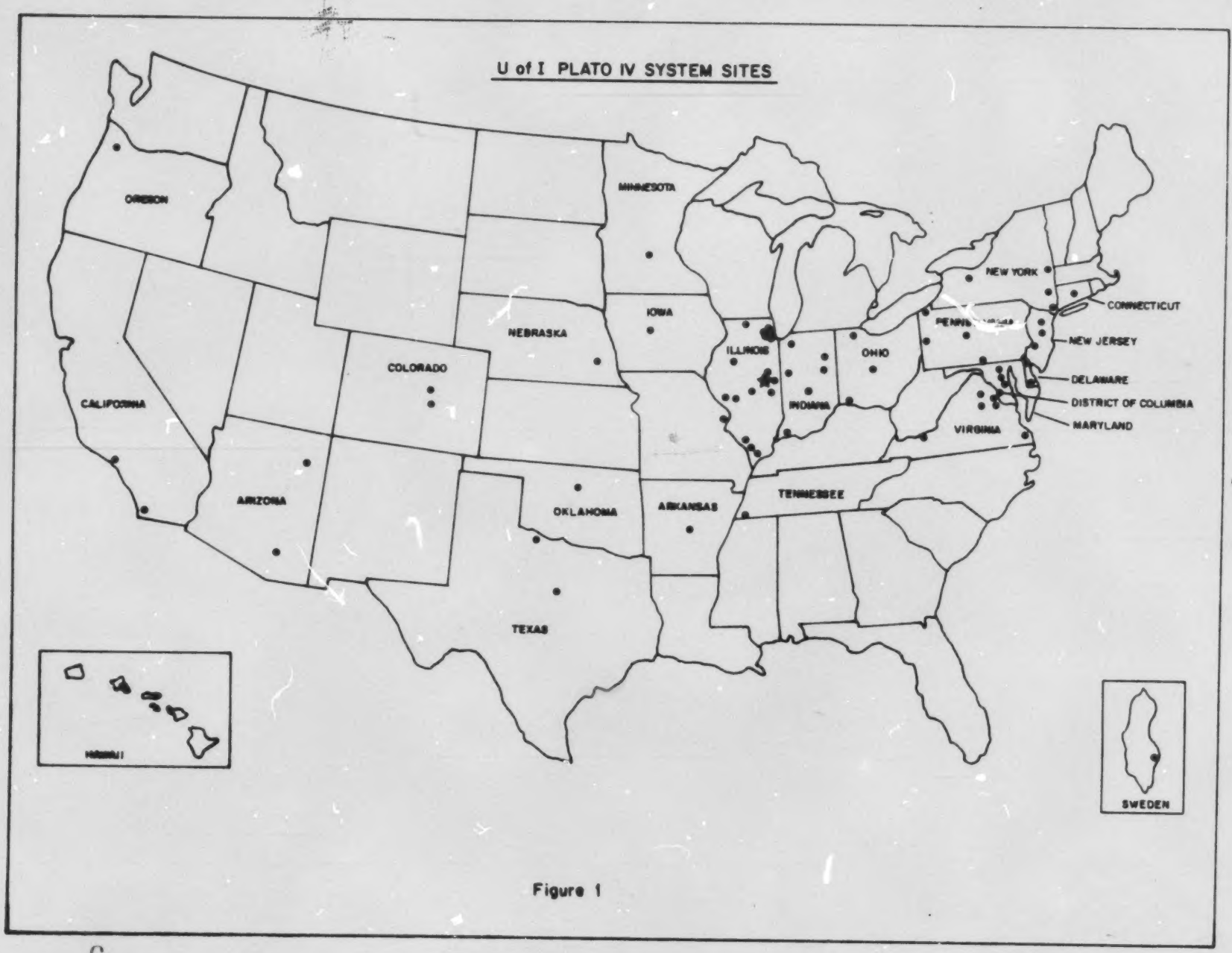
U of I PLATO IV SYSTEM SITES
OREGON
CALIFORNIA
ARIZONA
COLORADO
NEBRASKA
MINNESOTA
IOWA
ILLINOIS
INDIANA
OHIO
OKLAHOMA
ARKANSAS
TEXAS
TENNESSEE
VIRGINIA
NEW YORK
CONNECTICUT
NEW JERSEY
DELAWARE
DISTRICT OF COLUMBIA
MARYLAND
HAWAII
SWEDEN

Figure 1

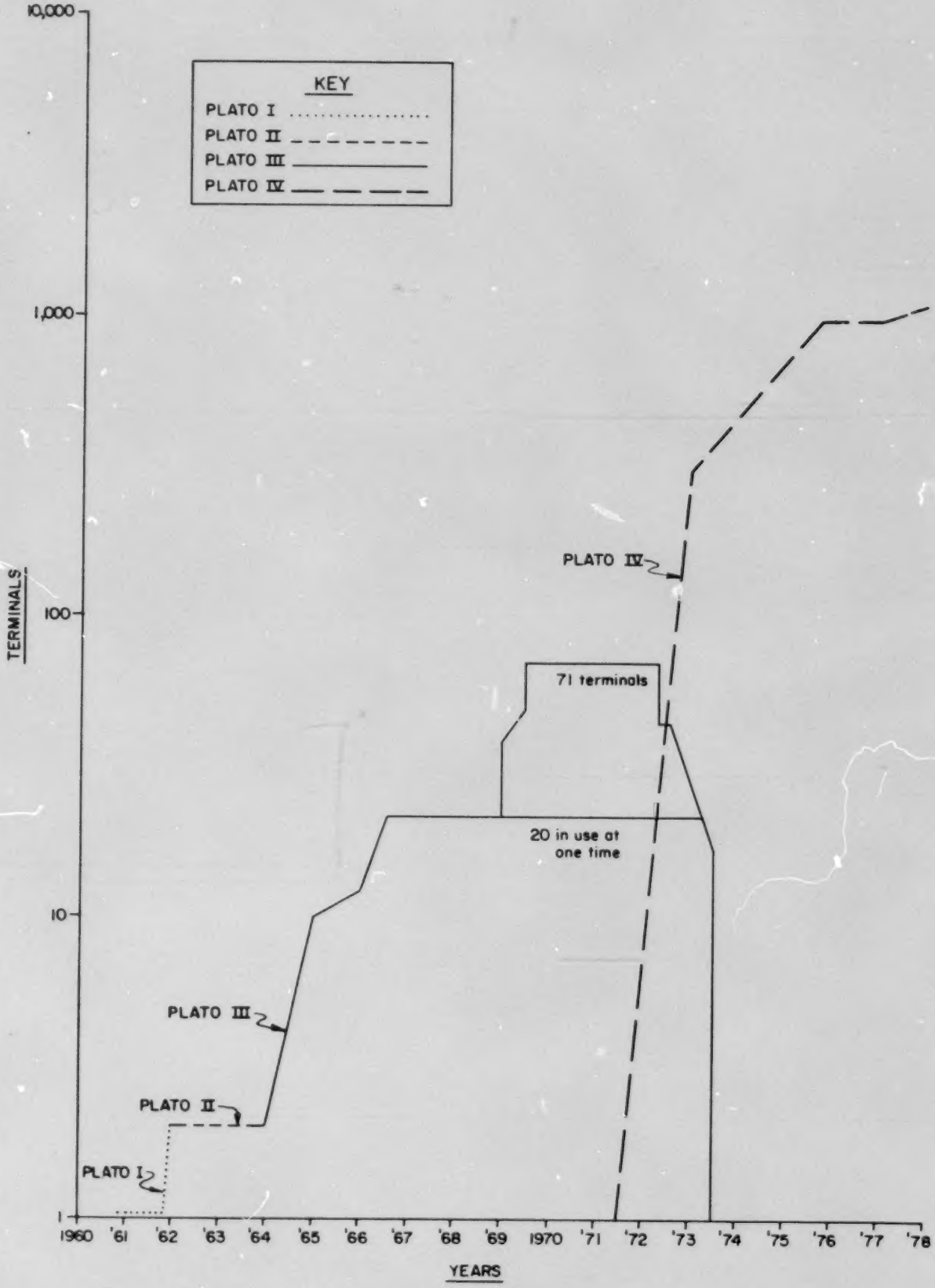

Figure 2 U of I PLATO TERMINALS

Development of the PLATO System

As a result of conversations in 1959 among engineers, physicists, psychologists and educators, research was started in 1960 in the Coordinated Science Laboratory at the University of Illinois to explore the possibilities of automation in individual instruction. A teaching system called PLATO (Programmed Logic for Automatic Teaching Operations) was invented and developed initially in the Coordinated Science Laboratory under the direction of Dr. Donald Bitzer. The PLATO system utilized a high speed digital computer as the central control element for teaching a number of students simultaneously.

In the course of the first seven years of PLATO's existence, the system grew from one terminal to seventy-one (twenty of which were operable simultaneously) (Figure 2), utilized three different computers (Figure 3) and employed four languages (Figure 4). During this period about 300 programs, of which 180 were lessons, were written for the system to illustrate or demonstrate its flexibility for teaching as well as for educational and other research (Figure 5).

In January 1967, the University of Illinois organized the Computer-based Education Research Laboratory and moved the PLATO project from the Coordinated Science Laboratory into the new laboratory. Dr. Bitzer continued the direction of the PLATO development. The purpose of the new laboratory was to continue the research and operation of the PLATO system. Work in the laboratory concentrated on the educational aspects of the PLATO III teaching system with particular emphasis on the most efficient use of PLATO III (the twenty terminal system) and on the development of the hardware (equipment), software (basic computer programs), and courseware (educational materials) for an economical large-scale computer-based educational system (PLATO IV).

From 1967 through 1972 the use of the PLATO III system reached peak capacity with approximately sixty hours assigned to student class time per week (Figure 6) and authors relegated to writing their lessons on the system from late evening until the early hours of the morning, while system programmers had to experiment on and correct the basic program problems during the rest of the night. The storage medium for PLATO lesson material was changed from magnetic tape to disk storage and the interactive interpretive program for the TUTOR language improved to allow time-sharing of the system by students and authors simultaneously as well as to add new features to the language. The computer and the available materials were then being used as efficiently as possible. Lesson material proliferated rapidly (Figure 5) and work in many new subject areas was tried.

The actual testing of the large scale computer-based educational system PLATO IV began with the arrival of many commercially manufactured PLATO IV terminals during the summer of 1972. These terminals utilized plasma display panels as the visual display rather than storage cathode ray and television tube presentation. Extensive development of the TUTOR language for PLATO IV enabled PLATO authors to convert their PLATO III lessons to the PLATO IV system and to dev-

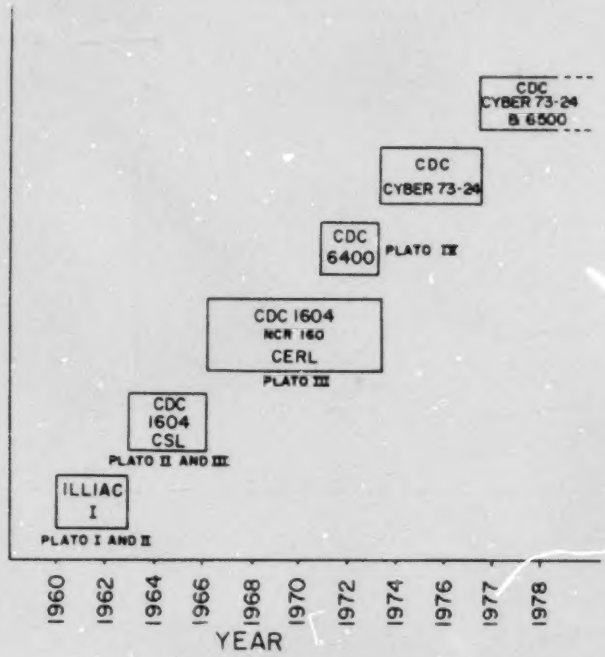

Figure 3 COMPUTERS

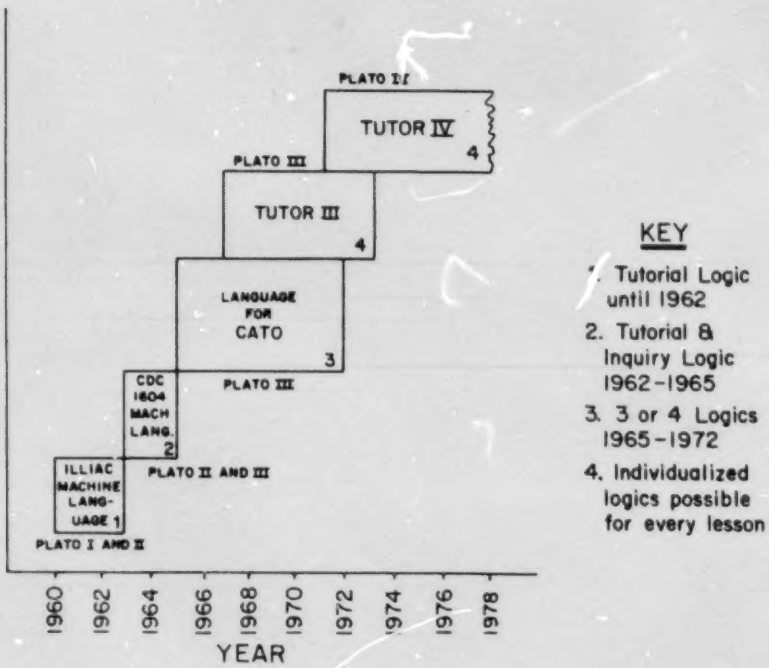

Figure 4 LESSON PROGRAMMING LANGUAGES

elop new PLATO material. Classes taught using PLATO IV terminals officially began in February 1973 and the teaching with PLATO III was phased out in June of that year.

Concurrent developments of improvements to the computer system, of the design and construction of auxiliary equipment, of the scope of the TUTOR language and of curricular materials has been the PLATO project pattern since 1973. Every phase of the system has either been improved or expanded. In February 1973, a new Control Data Company computer, CYBER 73-24, replaced the CDC 6000 series machine (Figure 3) and in February 1976 a CDC 6500 machine was added to operate simultaneously with the CYBER 73-24 to run the system. Extended core storage (ECS) was increased in February 1974 by 500,000 words to a total of one million words and in December 1974 to a total of two million words. Expansion of the disk storage system continued as needed with fourteen drives being in operation by January 1977. A random access slide projector, a touch panel attachment, a random access audio facility, and a music synthesizer have been developed as auxiliary equipment for the terminal. In the spring of 1977 one million words of auxiliary memory (AMS) were made available to the system. The AMS was a low-cost ECS equivalent memory developed by CERL. In addition, a second generation version of the PLATO terminal, the PPT (PLATO Programmable Terminal) was designed, tested and is in production with one hundred of the new terminals having been added to the present PLATO IV system during the fall of 1977.

The UI PLATO IV system supports terminals at about 158 locations, thirty-six on the campus of the University of Illinois and the others in locations ranging from Honolulu, Hawaii to Stockholm, Sweden and from Fort Hood, Texas to Minneapolis, Minnesota (Figure 1). The present system supports approximately 1000 terminals. Five other PLATO systems are now in operation, one at Control Data Corporation in Arden Hills, Minnesota, one at Florida State University in Tallahassee, Florida, one at the University of Quebec in Canada, one at the University of Delaware, Newark, Delaware and one in Brussels, Belgium. As predicted technological developments improve computer and communications systems, predictions are focussing on the eventual formation of an international grid of compatible regional networks providing a sophisticated computer-based information/communications network.

Along with the hardware development, the software for the system has been immeasurably improved. Many of the sophisticated refinements and extensions of the TUTOR language have been a result of suggestions from the many users on the system, suggestions arising as the users experimented with and developed curricular materials. The language is now highly flexible and offers capabilities from complex calculations for dazzling graphics to powerful judging routines.

An impressive outgrowth of the system's development has been the system's use as a communications medium. The highly interactive character of the PLATO system allows all kinds of interterminal communication giving rise to terminal to terminal communication, electronic mail, sophisticated consultation and authoring aids,

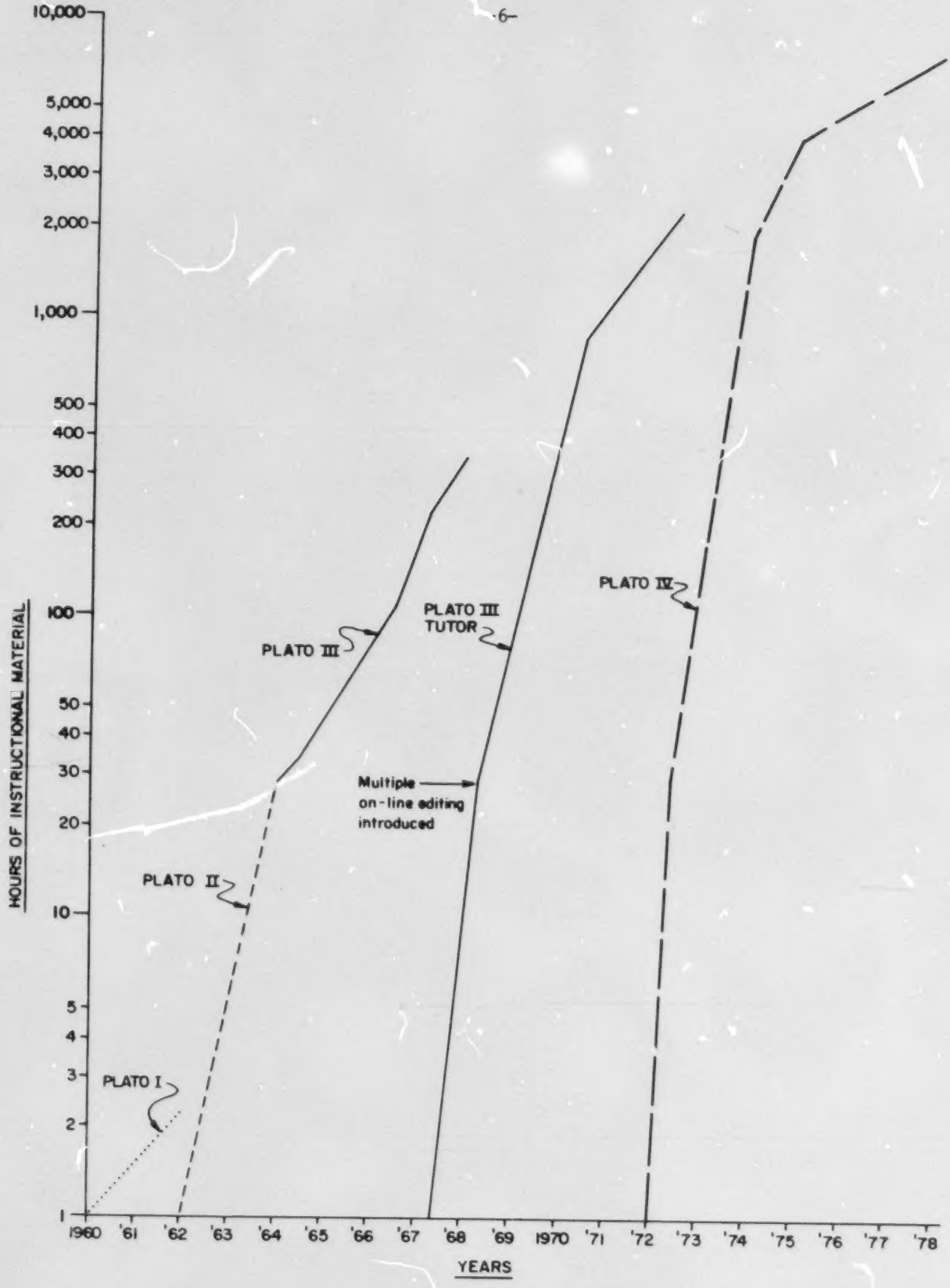

Figure 5 INSTRUCTIONAL MATERIAL
U of I PLATO SYSTEM

forums and rapid information exchange.

Curricular material development for the PLATO IV system has enjoyed a major emphasis during the past four years (Figure 5). Particular attention was paid between 1974 and 1976, at the request of those supporting the laboratory, to materials for the community college level and for elementary reading and mathematics. However, teaching materials for many other areas have also been written. Materials which have been tried out in the classroom are now available for about 6000 instructional hours in about 150 subject areas. Details on the available PLATO curricular materials are to be found in CERL Report, "PLATO Curricular Materials, No. 6" (November 1977).

An independent external evaluation of teaching using the PLATO system was undertaken between 1974 and 1976 in community college courses in accountancy, biology, chemistry, English, and mathematics at the Chicago City Colleges and at Parkland College in Champaign, Illinois, and in elementary school curricula in beginning reading and intermediate mathematics in several elementary schools in Urbana and Champaign. Educational Testing Service of Princeton, New Jersey, was the evaluator. The final reports of the study are cited in the bibliography at the end of this report.

The increase in student contact hours on the PLATO system from 1960 to 1974 is plotted in Figure 6. Accurate data available on the usage of the system by both authors and students for the years from 1974 to the present are shown in Figure 7. 4,062,875 terminal hours of use by students and authors were recorded between July 1, 1974 and February 1, 1978.

In the spring of 1976, following legal negotiation between the University of Illinois and Control Data Corporation, the Control Data Corporation announced plans for marketing PLATO systems and the establishment of learning centers in about forty metropolitan areas around the United States operated by the CBEducation Corporation. Courseware transfer to the CDC Arden Hills system has gradually taken place during 1976-1978 as authors have offered their lessons to Control Data Corporation for publication. Legal discussions between the University of Illinois and government funding agencies have resulted in agreements for release of courseware produced with government agency support.

Although the initial goal of the developers of the PLATO system was the provision of low-cost high quality computer-based education for thousands of users, the flexibility and scope of the system have led to a much wider variety of uses than ever initially imagined. Instruction is carried on at all levels from tiny youngsters to adults, from college-bound to vocational trainees, for those needing remedial, corrective or just supplementary work, in schools, corrective institutions, businesses and military training centers. Non-instructional applications range from entertainment, to personal services (medical appraisals, career planning, psychological testing, etc.), on-line research, data processing and information retrieval. The ideas for uses of the system are unlimited. "You name it, I can probably do it" could be the system's motto!

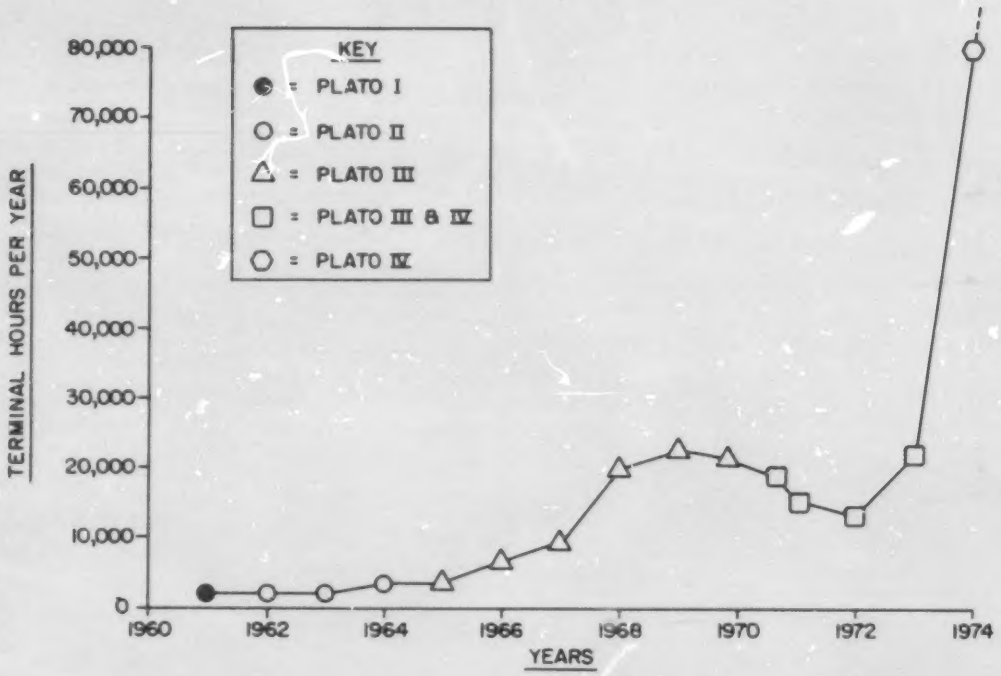

Figure 6 PLATO System Usage - 1960 to 1974 - Students Only

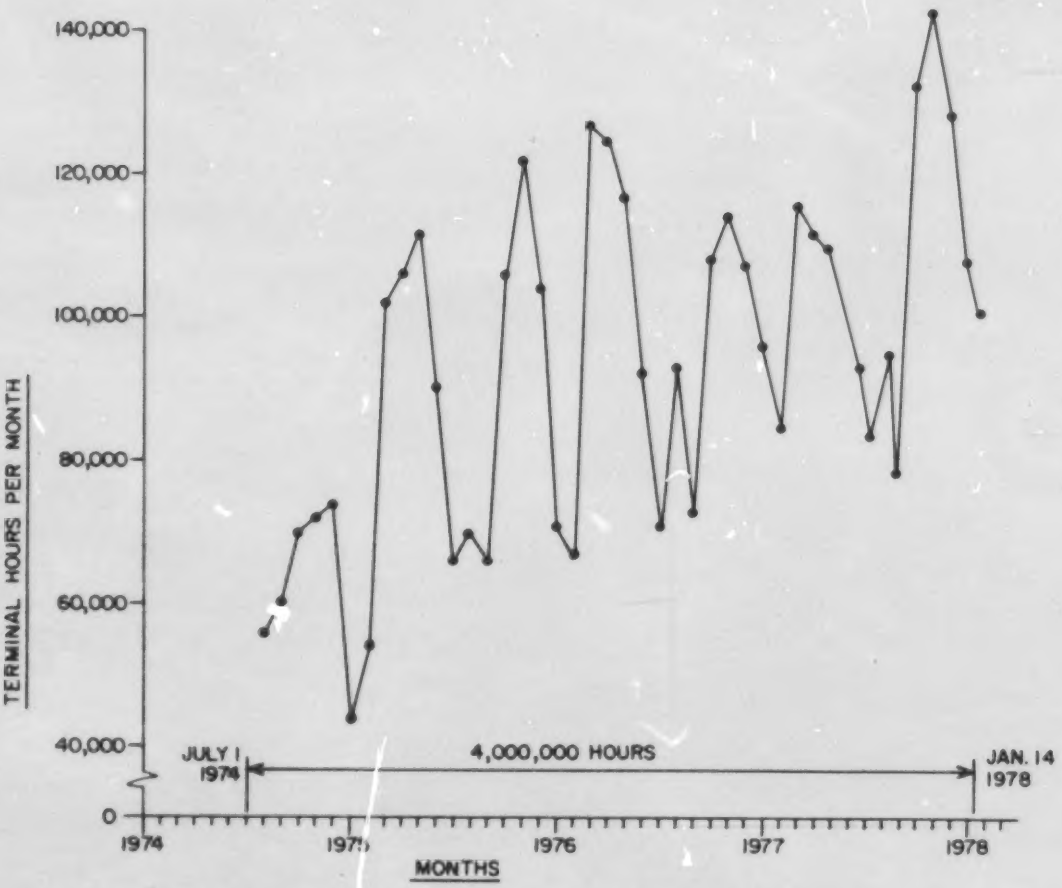

Figure 7 PLATO IV System Usage - July 1, 1974 to Feb 1, 1978 - Students and Authors

Financial Supporters of the PLATO Project

PLATO in the Coordinated Science Laboratory

1960-1962 Support extended to the Coordinated Science Laboratory of the University of Illinois jointly by the Department of the Army (Signal Corps)), Department of the Navy (Office of Naval Research), and the Department of the Air Force (Office of Scientific Research) under Signal Corps Contract DA-36-039-SC-85122

1962-1964 Support extended to the Coordinated Science Laboratory of the University of Illinois jointly by the Department of the Army, Department of the Navy (Office of Naval Research), and the Department of the Air Force (Office of Scientific Research) under Department of Army Contract DA-36-039-TR US AMC 02208 (E)

1964-1966 Support extended to the Coordinated Science Laboratory of the University of Illinois under the Joint Services Electronics Program by the Department of the Army, Department of the Navy (Office of Naval Research) and the Department of the Air Force (Office of Scientific Research) and by the Advanced Research Projects Agency under Department of Army Contract DA-28-043-AMC-0073 (E)

1966-1967 Same as 1964-1966 except under Contract DAAB07-67-C-0199

1964-1967 Advanced Research Projects Agency through Office of Naval Research under Contract OE-6-10-184

1966-1968 United States Office of Education under Contract OE-6-10-184

1966-1967 Control Data Corporation

PLATO in the Computer-based Education Research Laboratory

1967-1970	Subcontract from Mercy Hospital School of Nursing through contract under Nurse Training Act of 1964 from Public Health Service, Division of Nursing, United States Department of Health, Education and Welfare under Contract NPG-188-01
1967-1977	State of Illinois
1967-1978	Control Data Corporation
1967-1978	Owens-Illinois, Inc.
1968-1976	National Science Foundation under Contracts NSF GJ81, NSF GJ 974, NSF 65 29981, NSF C-723
1971-1978	United States Air Force Contracts
1971-1974	Ford Foundation under Contract 710-0293
1971-1974	United States Agency for International Development under Contract CSD-2937
1972-1974	Public Health Service
1972-1974	United States Department of Health, Education and Welfare through the Illinois Regional Medical Program
1972-1974	United States Air Force Contract F-41609-72-C-0050
1973-1977	Advanced Research Projects Agency through United States Army Contract DAAC-15-73-C-0077
1974-1975	Kettering Foundation
1972-1978	Many participating institutions on the U of I PLATO IV system
1976-1977	United States Department of Health, Education and Welfare
1976-1978	Urbana School District 116
1978	Office of Naval Research
1976-1978	Illinois Department of Corrections and Illinois Law Enforcement Assistance Association

Highlights in the History of the PLATO Project

PLATO in the Coordinated Science Laboratory

June 1960	First design for the PLATO system completed (single station consisting of keyset and CRT with provision for simultaneous display of computer-generated characters and photographic slide)
Fall 1960	Project goes into regular research operation in the Coordinated Science Laboratory (two hours a day using ILLIAC I computer)
November 1960	First formal demonstration of PLATO in operation
January 1961	PLATO II goes into operation (two stations operating simultaneously)
March 1961	First use of remote terminal with PLATO (thirty miles from the computer)
Spring 1961	PLATO first used with instructional material (high school math and French grammar)
Fall 1961	College level material first used on PLATO (Network Synthesis lessons)
Spring 1962	PLATO first used to provide part of accredited college course (Math 195, University of Illinois)
Summer 1962	Inquiry type logic developed for PLATO
November 1962	PLATO first used to collect and process physiological information (heart rate) as part of student response data
January 1963	PLATO shifts from ILLIAC I to CDC 1604 computer
Spring 1963	PLATO first used to provide part of accredited professional course (Nursing)
Fall 1963	PLATO III first used (capability for expansion to thirty-two stations)
June 1964	Two different lessons simultaneously available to class using PLATO
October 1964	Provision for inter-terminal communication between PLATO terminals completed
Fall 1964	PLATO used for control of real experiments in physical sciences (all stations able to observe outcome and perform analysis of results)

December 1964 On-line editing of PLATO lessons possible while students use lessons

January 1965 CATO (Compiler for Automatic Teaching Operations) completed

Spring 1965 PLATO first used for extensive portion of accredited course (EE 322)

Fall 1965 First college course (Library Science 195) given completely by PLATO

March 1966 Expansion of PLATO III to twenty terminals completed

May 1966 PLATO operating on own CDC 1604 computer

Summer 1966 Multiple on-line author editing program first used (MONSTER tape editor)

PLATO in the Computer-based Education Research Laboratory

January 1967 Computer-based Education Research Laboratory (CERL) formed for continued operation of and research on PLATO

Summer 1967 TUTOR author language first used on PLATO (specifically designed for authors with no background in computer use)

March 1968 NSF grant awarded for first steps in development of PLATO IV (ultimately to consist of more than 1000 terminals requiring only telephone line communication with a large central computer). Terminals use the plasma display panel developed at the University of Illinois instead of the more costly CRT presentation

June 1968 Disk storage added giving on-line editing capability to authors while students are operating (any combination of up to twenty authors or students simultaneously operating)

June 1968 Delivery of first commercially produced 4"x4" plasma panel (Owens-Illinois)

December 1968 Fourteen station remote PLATO demonstration center in operation at Mercy Hospital (three other centers operating by February, 1969)

June 1969 Multiple disk storage in operation. Up to 150 lessons available to students (for use) or authors (for editing during a class session)

November 1969 One remote station operating at Springfield High School, Springfield Illinois, ninety miles from Urbana

Summer 1970	720 hours of instructional material developed; 100,000 student contact hours of use by this date
January 197[illegible]	On-line remote demonstration for NSF in Washington, D.C.
May 1971	Delivery of first 512x512 Digivue display memory device from Owens-Illinois
June 1971	Delivery of first PLATO IV terminal from Magnavox Company
Summer 1971	1100 hours of instructional material developed. 130,000 student contact hours of use by this date
January 1972	Four PLATO IV terminals in operation
June 1972	Twenty PLATO IV terminals in operation. On-line PLATO IV demonstrations between January 1972 and June 1972 in many locations from California to Massachusetts, Canada to Texas
Summer 1972	On-line PLATO IV demonstrations in Italy, Germany, and Switzerland
August 1972	Forty PLATO IV terminals in operation
Fall 1972	Intensive PLATO IV lesson development
Winter 1972	250 PLATO IV terminals in operation at approximately forty locations (fifteen on the University of Illinois campus and about twenty-five off campus)
February 1973	CDC CYBER 73-24 computer installed replacing the CDC 6400
June 1973	Phasing out of the use of the PLATO III system for teaching
June 1973	PLATO on-line demonstration in Mexico
September 1973	PLATO on-line demonstration in Sweden
Fall 1973	300 PLATO IV terminals in operation at fifty sites
November 1973	PLATO on-line demonstration in the Soviet Union - five terminals, Russian keysets
Winter 1973-1974	Second PLATO system started by Control Data Corporation in Minnesota

January 1974	500,000 words of extended core storage (ECS) added
February 1974	1500 hours of available PLATO IV instructional material. 1500 more hours of instructional material in preparation. Over ninety college courses using the PLATO system
March 1974	450 terminals operable; new disk system operational (CDC 844)
April 1974	Second PLATO system operational at Control Data Corporation, Minneapolis, Minnesota
July 1974	700 terminals operable; 2500 hours of available curricular materials
Summer 1974	PLATO on-line demonstration in Bucharest, Rumania
September 1974	Formal external PLATO evaluation started by the Educational Testing Service for NSF
Fall 1974	PLATO terminals located at approximately 100 sites: twenty-three sites on the campus at the University of Illinois, eight in elementary schools, one in a high school, as well as terminals at about forty colleges and universities, seventeen government projects and twelve miscellaneous sites
Fall 1974	Third PLATO system in operation at Florida State University, Tallahassee, Florida
December 1974	Addition of 1,000,000 words of extended core storage
Spring 1975	Many lessons written in other CAI languages (particularly medical lessons) being translated to TUTOR for use on the PLATO system
Summer 1975	PLATO IV terminals located at 146 sites: twenty-six sites on the University of Illinois campus, ten elementary schools, three high schools, six community colleges, twenty-two government-supported institutions, thirty-one medical sites (seventeen situated at colleges or universities), thirty-two colleges and universities, sixteen miscellaneous sites
November 1975	One million terminals hours of usage by students and authors logged in the period between January 1, 1975 and November 19, 1975. Approximately 1500 authors on the system using 11,000 lesson spaces of which over 4500 are considered "finished lessons" varying in student completion time from a few minutes for some to several hours for others

March 12, 1976	Control Data Corporation - University of Illinois legal agreement signed, confirmed by the University of Illinois Board of Trustees on April 14
April 1976	Control Data Corporation public announcement of plans for marketing the PLATO system
May 1976	2,000,000 terminal hours of PLATO IV use between July 1, 1974 and May 24, 1976
August 1976	University of Quebec, Quebec, Canada - fourth PLATO IV system. Approximately 5000 hours of available instructional material on the University of Illinois system. PLATO lesson publication initiated by Control Data Corporation
Fall 1976	140 sites on the University of Illinois PLATO IV system: twenty-six on campus, nine elementary schools, six high schools, six community colleges, twenty government related installations, twenty-seven medical sites (fifteen at colleges or universities), thirty colleges and universities, and about twenty miscellaneous installations
September 1976	CDC Cyber 73-24 and CDC 6500 running simultaneously operating the University of Illinois PLATO system
1976	Remote demonstrations in Hawaii, Iran, Australia and Venezuela
January 1977	System output rate changed from 1260 to 1200 bits per second
April 1, 1977	Three million contact hours (students and authors) logged on the University of Illinois PLATO system since July 1974
Spring 1977	Installation of one million words of auxiliary memory (AMS)
June 1977	Terminals installed in Honolulu, Hawaii
Sept. 1977	First regular delivery of PLATO V (PPT) terminals
Jan. 14, 1978	Four million terminal hours of usage by students and authors since July 1, 1974. 158 sites on the U of I PLATO system
February 1978	Two new systems added to the PLATO network, one in Brussels, Belgium and one at the University of Delaware in Newark, Delaware

CHRONOLOGICAL LIST OF PLATO PUBLICATIONS

A bibliography of PLATO articles appears on the following pages listed in chronological order of publication.

Articles in the bibliography marked with the symbol (#) may be purchased from CERL. Xerox copies of out-of-print CERL articles may be ordered at the price of ten cents per page. Some reports may be procured through the ERIC Clearing House.

Orders for CERL reports should be sent to:

PLATO IV Publications
Computer-based Education Research Laboratory
252 Engineering Research Laboratory
University of Illinois
Urbana, Illinois 61801

PLATO ARTICLES PUBLISHED IN 1961

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